W. J. LEARY

CITY OF HELENA

HELENA, MONTANA

SUPPLEMENT TO A REPORT COVERING POTENTIAL SOURCE OF WATER SUPPLY FOR A LONG-RANGE PLAN OF DEVELOPMENT OF THE HELENA WATER SYSTEM

DATED NOVEMBER, 1955

Phillips-Carter-Osborn, Inc.
Engineers
Denver, Colorado

January, 1956

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ORLEY O. PHILLIPS E. H. CARTER L. C. OSBORN

PHILLIPS-CARTER-OSBORN, INC.
ENGINEERS
SIXTH FLOOR INSURANCE BUILDING
DENVER 2, COLORADO
PHONE ACOMA 2-2603

January 15, 1956

Honorable Board of City Commissioners
and City Manager
City of Helena
Helena, Montana

Gentlemen:

At your request, we have reviewed the two most recent proposals submitted to the City of Helena by representatives of the United States Bureau of Reclamation, wherein it is proposed to make available to the City of Helena, Missouri River water to be delivered at the proposed Helena Valley Reservoir of the Helena Valley Project.

One proposal provides for the delivery of water sufficient to meet the estimated requirements of the City during the ensuing 25 years and the other proposal provides for the delivery of water sufficient to meet the estimated requirements of the City for the ensuing 50 years.

We have made a thorough financial study of all alternate schemes which appear feasible and it is our conclusion that it would be to the best interests of the City to augment its present water supply by participation in the Helena Valley Project for a 50 year supply.

Accordingly, it is our recommendation that the City enter into negotiation of a contract with the United States Bureau of Reclamation which, when consumated, will assure the City of Helena a permanent raw water supply from the Helena Valley Reservoir in an amount up to 5,680 acre feet per annum.

The report herewith sets forth our analysis, upon which the foregoing conclusion and recommendation are based.

Very truly yours

PHILLIPS-CARTER-OSBORN, INC.

L. C. Osborn

L. C. Osborn

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INTRODUCTION

On December 7, 1955, Messrs. Phillips and Osborn, of the engineering firm of Phillips-Carter-Osborn, Inc., attended a meeting of the City Commissioners and City Manager of the City of Helena, Montana.

At this meeting the Engineers discussed the report previously submitted to the City officials, captioned "Report Covering Potential Sources of Water Supply for a Long-Range Plan of Development of the Helena Water System," dated November, 1955.

In the report the Engineers recommended that the City augment its present water supply by developing Missouri River water from Hauser Lake, without participating in the Helena Valley Project of the United States Bureau of Reclamation. The basis of the recommendation was the allocated cost of participation in the Helena Valley Project, as stated by the Bureau in a letter dated October 11, 1955.

In attendance at the meeting heretofor mentioned were representatives of the United States Bureau of Reclamation, who orally presented revised estimates of allocated costs for City participation in the Helena Valley Project which were more favorable than those proposed in their letter of October 11, 1955.

The City officials of Helena requested the Engineers to review the Bureau's revised proposals and report thereon.

The Bureau submitted to the Engineers the revised proposals in a letter dated December 8, 1955. A copy of the letter is attached hereto as Appendix A.

The Bureau offered two proposals which are summarized as follows:

Period	Extent of Supply Acre Feet Max. Annual	For Period	Allocated Cost Capital	Per A. F.	Repayment Period
25 Year	3,110	43,804	$477,000	$ 10.88	25 Years
50 Year	5,680	153,824	728,000	4.73	40 Years

A cost analysis of each of the above proposed supplies is submitted hereinafter.

GENERAL

The Hauser Lake Project without Bureau participation would require that the City provide a treatment plant and pumping plant at Hauser Lake, together with a pipeline to conduct the water to the City of Helena.

Should the City participate in the Helena Valley Project, the same facilities would be required. However, the Bureau would deliver water to the City's treatment plant from a storage reservoir nearer to the City and at a higher elevation than Hauser Lake. Such a scheme would reduce the capital expenditures by the City for the construction of the required facilities and would therefore also reduce the charges for depreciation. Obviously, power costs for pumping would also be less. However, it would be required that the City repay the Bureau's allocated cost, with interest at 2-1/2 per cent, of the enlargement of their facilities necessitated to make water available to the City at the Helena Valley Storage Reservoir.

The cost of the water treatment plant will be the same for either location; therefore, its cost is not considered in the analysis herein.

25 YEAR SUPPLY

Comparable costs accruing to the two schemes over a 25-year period of supply are shown in the tabulations which follow:

Capital Costs of Facilities Furnished by City Exclusive of Water Treatment Plant

	Hauser Lake		Helena Valley Project	
Pipeline	$ 686,000		$ 517,200	
Engr. & Contingent	171,500		129,300	
Subtotal		$ 857,500		$ 646,500
Pumping Plant	$ 90,000		$ 67,500	
Engr. & Contingent	22,500		16,875	
Subtotal		112,500		84,375
Total		$ 970,000		$ 730,875

Total Capital Cost for 25-Year Supply

	Hauser Lake	Helena Valley Project
City	$ 970,000	$ 730,875
U. S. B. R.	--	477,000
Total	$ 970,000	$1,207,875

Annual Depreciation Charge

	Hauser Lake	Helena Valley Project
Pipeline at 50 years	$ 17,150	$ 12,930
Pumping Plant at 25 years	4,500	3,375
Total Annual	$ 21,650	$ 16,305

Power Costs for 25-Year Period (43, 804 Acre Feet)

	Hauser Lake	Helena Valley Project
Total	$ 402, 995	$ 316, 695
Per Acre Foot	$ 9. 20	$ 7 . 23

Based upon the foregoing assumptions relative to costs, the total cost of supplying water to the City of Helena over a 25-year period was computed in several different manners which are summarized in Table I, titled, "Cost Analysis of Helena Valley 25-Year Supply U. S. B. R. Cost Allocation $477, 000."

It is to be noted that Method C in the foregoing tabulation may not be realistic because the Bureau's allocation of $477, 000 is retired over a period of 40 years instead of 25 years. Such a method of financing may not be acceptable to the Bureau. This computation was made on the theory that should the Bureau consider financing a 50-year supply over a period of 40 years, the same period of financing by the Federal Government should also be applicable to any other scheme.

COST ANALYSIS OF HELENA VALLEY 25 YEAR SUPPLY U.S.B.R. COST ALLOCATION $ 477,000

Method	Description of Method	Capital Cost	Cost Over a 25 Year Period * Total	Cost Over a 25 Year Period Per Acre-Foot	Unretired Allocation
B	Hauser Lake without U.S.B.R. Participation	$ 970,000	$ 2,336,870	$ 53.34	--
C	U.S.B.R. Allocation Retired in 40 equal annual payments	1,207,875	2,248,695	51.25	$ 235,000
D	U.S.B.R. Allocation Retired in 25 Equal Annual Payments	1,207,875	2,420,895	55.26	--
E	U.S.B.R. Allocation Retired in 25 Annual Graduated Payments as Proposed by That Agency	1,207,875	2,537,117	57.91	--

Includes: Repayment of city costs in 25 equal annual payments with interest at 3%
Repayment of U.S.B.R. Allocated cost as stated with interest at 2-1/2%
Power costs and depreciation charges

Excludes: Operation and maintenance costs

Detailed computations for each method are in the appendix as designated.

* For 43,804 Acre-Feet.

Table I

50-YEAR SUPPLY

When giving consideration to a 50-year supply the facilities required for the 25-year supply, as provided by the City, would require duplication at the end of the 25-year period, in which event the estimated capital costs to be incurred by the City at that time would be as follows:

Total Capital Cost for the 50-Year Supply

(Note: See Page 3 for Total Capital Cost for the 25-Year Supply)

	Hauser Lake	Helena Valley Project
City	$ 1,940,000	$ 1,461,750
U. S. B. R.	--	728,000
Total	$ 1,940,000	$ 2,189,750

Annual Depreciation Charge

	Hauser Lake	Helena Valley Project
Second Pipeline 50 Years	$ 17,150	$ 12,930
First Pipeline	17,150	12,930
Pumping Plant 25 Years	4,500	3,375
Total	$ 38,800	$ 29,235

In making the above computations, it is assumed that the cost of the first pumping plant had been written off, but the cost of the first pipeline would not be completely depreciated until the end of a second 25-year period. As a matter of fact, it would be appropriate to also increase the depreciation of the second pumping plant for the second 25-year period.

Such an assumption would be favorable to the U. S. B. R. Helena Valley Project. The fallacy of the assumed computations is the fact that the cost of constructing any facility 25 years hence cannot be estimated with any degree of accuracy. However, the assumed capital costs and depreciation costs are considered comparable when used to analyze costs.

Power Costs for 50-Year Period(153, 824 Acre Feet)

	Hauser Lake	Helena Valley Project
Total	$ 1, 382, 173	$ 1, 083, 535
Per Acre Foot	$ 8. 98	$ 7. 04

Based on the foregoing assumptions, the cost of furnishing water to the City of Helena over a period of 50 years was computed. A summary of this study is shown in Table II, titled, "Cost Analysis of Helena Valley 50-Year Supply U. S. B. R. Cost Allocation $ 728, 000." Also shown in Table II is the cost to the City during a 25-year period, should the City participate in the Bureau's 50-year supply.

COST ANALYSIS OF HELENA VALLEY 50 YEAR SUPPLY U.S.B.R. COST ALLOCATION $ 728,000

Method No.	Description of Method	Capital Cost	Period Years	Cost over Period * Total	Cost over Period Per Acre-Foot	Unretired Allocation
F	U.S.B.R. Allocation Retired in 25 Equal Annual Payments. City Capital Costs Retired in 25 Equal Annual Payments.	$ 1,458,875	25	$ 2,761,445	$ 63.05	--
G	U.S.B.R. Allocation Retired in 40 Equal Annual Payments. City Capital Costs Retired in 25 Equal Annual Payments.	1,458,875	25	2,498,645	57.04	$ 359,000
H	U.S.B.R. Allocation Retired in 40 Annual Graduated Payments as Proposed by That Agency. City Capital Cost Retired in 25 Equal Annual Payments.	1,458,875	25	2,369.401	54.00	577,000
I	U.S.B.R. Allocation Retired in 40 Equal Annual Payments, City Capital Costs Retired in Equal Annual Payments Over Two 25 Year Periods.	2,189,750	50	5,480,685	35.63	--
J	Hauser Lake Supply Without U.S.B.R. Participation. City Capital Costs Retired in Equal Annual Payments Over Two 25 Year Periods.	1,940,000	50	5,678,673	36.92	--

Includes: City costs retired as stated interest 3%
U.S.B.R. costs retired as stated interest 2-1/2%
Power costs and depreciation charges.

Excludes: Operation and maintenance costs.

* For 153,824 Acre-Feet.

Table II

RECAPITULATION

The City of Helena will exist for an indefinite period of time and during its existence it must assume the responsibility of supplying water to its inhabitants.

When considering the participation with the United States Bureau of Reclamation to provide a water supply for the City of Helena, it must be recognized that the procurement of a water supply from that Agency limited to that required at the end of 25 years would be in the nature of a stop-gap policy and therefore should not be given serious consideration.

The difference in the facilities required to be constructed by the Bureau in order to make a water supply available to the City of Helena, as compared to that necessary to supply water for the Helena Valley Irrigation District only, has not been definitely set forth, nor has the difference in facilities required to make available a 50-year supply to Helena, rather than a 25-year supply, been definitely explained by the U. S. B. R. It is recognized that the Helena Valley Reservoir, as well as the feeder canal supplying it, must be enlarged to supply Helena with a 25-year supply, and further enlarged to make available a 50-year supply. Probably the allocated costs submitted by the Bureau for the two supplies are estimates of the actual costs entailed; in any event, they are made by the Bureau in the nature of a firm commit ment.

A comparison of the allocation of cost as set forth by the Bureau is as follows:

Supply Years	Cost Allocated	Max. Annual Capacity	Cost per Acre Foot of Capacity
50	$ 728,000	5,680	$ 128.16
25	477,000	3,110	153.37
Difference	$ 251,000	2,570	

Additional Cost of 2,570 Acre Feet - $97.66 per Acre Foot.

By inspection of the foregoing table, it is apparent that should the City participate with the Bureau to augment its water supply, it should be on a 50-year basis. This is true in particular because the Bureau's allocation of $ 728,000 is fixed. There is no way of estimating what costs may be 25 years hence, as compared to present costs. Present trends indicate they will be considerably higher. By participating in the 50-year supply, rather than the 25-year supply, the supply made available will be increased by 83 per cent at an additional capital cost of 53 per cent.

The cost analysis demonstrates that should the City participate in the Helena Valley Project for a 50-year supply, the cost over a 50-year period would be $5,480,685, whereas should the City develop the Hauser Lake supply independent of the Bureau, the cost over a 50-year period would be $5,678,673. The above costs are exclusive of maintenance costs. Should $100,000 be added to the cost ($2,000 per annum for 50 years) of the Helena Valley Project for maintenance, the cost over the 50-year period would still be less than the Hauser Lake development over the same period. (See Appendix I and J)

Bear in mind that some maintenance cost would also accrue to the extra length of pipeline that would be required, should the Hauser Lake supply be developed by the City.

CAPITAL COST RETIREMENT

It is to be noted that when analyzing the cost of the Helena Valley Project and the Hauser Lake Project over a 50-year period, the cost allocation of the Bureau facilities was retired in 40 annual equal payments. This was done in order that the two schedules (Appendix I and J) be on a comparable basis. This method of analysis results in less cost to the Helena Valley Project than should the graduated payments offered the Bureau be used instead. However, it can be demonstrated by calculations that should the difference in the annual costs accruing from the graduated payments offered by the Bureau and the equal annual cost repayment be deposited in a sinking fund, with interest at 3 per cent, the result over a 40-year period would be practically identical. It is doubtful if the City could count on 3 per cent interest; however, should the saving be used to retire bonds drawing interest at 3 per cent, it would amount to practically the same thing.

The idea of graduated payments, consisting of a base payment plus payment for water consumed in order to retire allocated cost, should be attractive to the City, because it amounts to payment for water as consumed. This should also amount to repayment corresponding to the revenue from the sale of water by the City.

It is noted that in the repayment schedule offered by the Bureau for the 50-year supply retired in 40 years, the base payment is at the rate of $9,700 per year for 600 acre feet per annum. When the estimated annual cost of $2,000 for operation and maintenance is deducted from this amount, the base payment becomes $7,700. This amount is less than the interest on $728,000 at 2 1/2 per cent, which is $18,200 per annum.

It is demonstrated in the tabulation in Appendix K that under the Bureau's suggested repayment schedule, the allocated cost repayable to the Federal Government would not be reduced until 20 years shall have expired, and not even then should the amount of water supplied to the City be less than estimated. Appendix K also demonstrates that at the 10th year the capital cost due the Federal Government has increased from $728,000 to $806,000. This is not good financial management.

It is suggested that a better financial arrangement would be for the City to agree to a base payment of $18,200 per year for 600 acre feet, provided the cost of $14 per acre foot for water consumed in excess of 600 acre feet be reduced to $7.00 per acre foot.

A tabulation showing the computations under such procedure is shown in Appendix L.

A comparison of the two methods of financing is shown in the following table:

Retirement of Allocated Cost of $728,000
Over 40-Year Period

Quantity A. F.	Repayment Schedule	
	U. S. B. R. (See Appendix K)	As Suggested (See Appendix L)
Base 24,000	$ 308,000	$ 728,000
Excess 78,244	1,095,416	547,708
Total 102,244	$1,403,416	$1,275,708
Per Acre Foot	$13.73	$ 12.48

Maintenance and Operation Cost:

The Bureau in its proposal includes an item of $2,000 per annum, as estimated O and M and R costs over the 40-year period. Should this cost be fixed by contract for the period, it would probably be acceptable to the City. In the event this charge is an estimate only, the contract should provide that the annual O and M and R cost should be based upon the use of facilities to and including the Helena Valley Reservoir. For example, should in a certain year the amount of water delivered to the Helena Valley Reservoir amount to 60,000 acre feet, and the cost of O and M and R to and including the reservoir amount to $30,000, or $0.50 per acre foot, then should the City diversion during the year be in the amount of 2,500 acre feet, the City's share of the O and M and R charge for that year should be $1,250.

Termination of Contract.

It is understood that at the end of the 40-year period, should the City have repaid to the Bureau the allocated cost of $728,000, with interest

at 2 1/2 per cent, the City should then have use of all of the facilities without further payment, except its share of the annual O and M and R charges.

The contract should also provide that the City acquire water resources in perpetuity from the Missouri River in the amount of 5, 680 acre feet per annum.

APPENDIX A-1

UNITED STATES
DEPARTMENT OF THE INTERIOR
Bureau of Reclamation
Regional Office, Region 6
P. O. Box 2130
Billings, Montana

COPY

In Reply Refer To:
400

Air Mail

Phillips-Carter-Osborn, Incorporated
601 Insurance Building
Denver 2, Colorado

Attention: Mr. B. C. Hildyard

Gentlemen:

Reference is made to our letter of October 11, 1955, which transmitted a construction cost allocation to the municipal water function of the Helena Valley Unit and to the December 7 meeting in Helena, Montana, among representatives of the City of Helena, your firm and the Bureau of Reclamation.

Our analysis of the repayment problems has changed somewhat after being advised of various items as presented in your report on potential sources of municipal water for the City of Helena. Our allocation of costs is partially based upon the lowest cost alternative source of supply of which your estimate of such alternative was somewhat lower than previously used in our calculations. A reanalysis of our allocations reduced the costs of a 50-year water supply to $728,000.

The water service contract now proposed with the City of Helena would require an annual base payment of $9,700 for a maximum of 600 acre-feet of water with additional water above 600 acre-feet to be furnished at the rate of $14.00 per acre-foot. The payout analysis was based on the assumption that Helena would require an average supply of 3,058 acre-feet annually during a 50-year period and that the ultimate requirement the fiftieth year would be 5,680 acre-feet. This would cover the estimated 50-year capital costs, including an estimated annual O&M&R cost of $2,000, within a 40-year contract period.

Another allocation of costs based upon a 25-year period of

analysis was made for comparison with certain cost figures as presented in your report. This resulted in an allocation of costs to municipal water from the Helena Valley Unit of $477,000, and would require an annual base payment of $11,100 for a maximum of 600 acre-feet of water, with additional water above 600 acre-feet to be furnished at the rate of $18.00 per acre-foot. The average annual water use during the 25-year period was 1,715 acre-feet and was estimated to be 3,110 acre-feet in the twenty-fifth year. Operation, maintenance and replacement under this analysis was estimated to be $1,300 annually.

Tabulations covering each of the two periods of analysis are enclosed for your information and use.

We will be happy to furnish you with additional information if it should be desired for your further analysis.

Very truly yours,

/s/ F. M. Clinton

Regional Director

Enclosures 2

APPENDIX A-3

FORTY YEAR PAYOUT ANALYSIS, CITY OF HELENA, MONTANA

December 7, 1955

Year	Estimated Usage - Ac. Ft.		Annual Payments		
	Base	Excess	Base	Excess @ $14.00	Total
1	600	0	$9,700	---	$ 9,700
2				---	9,700
3				---	9,700
4				---	9,700
5		110		$ 1,540	11,240
6		250		3,500	13,200
7		390		5,460	15,160
8		520		7,280	16,980
9		650		9,100	18,800
10		780		10,920	20,620
11		910		12,740	22,440
12		1,020		14,280	23,980
13		1,150		16,100	25,800
14		1,280		17,920	27,620
15		1,400		19,600	29,300
16		1,530		21,420	31,120
17		1,640		22,960	32,660
18		1,770		24,780	34,480
19		1,880		26,320	36,020
20		1,990		27,860	37,560
21		2,100		29,400	39,100
22		2,214		30,996	40,696
23		2,300		32,200	41,900
24		2,410		33,740	43,440
25		2,510		35,140	44,840
26		2,610		36,540	46,240
27		2,710		37,940	47,640
28		2,800		39,200	48,900
29		2,900		40,600	50,300
30		3,000		42,000	51,700
31		3,100		43,400	53,100
32		3,200		44,800	54,500
33		3,300		46,200	55,900
34		3,400		47,600	57,300
35		3,500		49,000	58,700
36		3,600		50,400	60,100
37		3,690		51,660	61,360
38		3,780		52,920	62,620
39		3,880		54,320	64,020
40	600	3,970	9,700	55,580	65,280

APPENDIX A-4

TWENTY-FIVE YEAR PAYOUT ANALYSIS, CITY OF HELENA, MONTANA

December 7, 1955

Year	Estimated Usage - Ac. Ft.		Annual Payments		
	Base	Excess	Base	Excess @ $18.00	Total
1	600		$11,100	--- --- ---	$11,100
2				--- --- ---	11,100
3				--- --- ---	11,100
4				--- --- ---	11,100
5		100		$ 1,980	13,080
6		250		4,500	15,600
7		390		7,020	18,120
8		520		9,360	20,460
9		650		11,700	22,800
10		780		14,040	25,140
11		910		16,380	27,480
12		1,020		18,360	29,460
13		1,150		20,700	31,800
14		1,280		23,040	34,140
15		1,400		25,200	36,300
16		1,530		27,540	38,640
17		1,640		29,520	40,620
18		1,770		31,860	42,960
19		1,880		33,840	44,940
20		1,990		35,820	46,920
21		2,100		37,800	48,900
22		2,214		39,852	50,952
23		2,300		41,400	52,500
24		2,410		43,380	54,480
25	600	2,510	11,100	45,180	56,280

APPENDIX B

HAUSER LAKE

Cost of Supply Over 25 Year Period
Capital Cost of $970,000 Retired in
25 Equal Annual Payments (Interest 3%)

Year	Acre Feet	Capital Cost Repayment	Power Cost	Depreciation Charge	Total Annual
1	600	$ 55,705	$ 4,510	$ 21,650	$ 81,865
2	600	55,705	4,740	21,650	82,095
3	600	55,705	4,970	21,650	82,325
4	600	55,705	5,100	21,650	82,455
5	710	55,705	6,600	21,650	83,955
6	850	55,705	8,250	21,650	85,605
7	990	55,705	9,900	21,650	87,255
8	1,120	55,705	11,625	21,650	88,980
9	1,250	55,705	12,600	21,650	89,955
10	1,380	55,705	13,600	21,650	90,955
11	1,510	55,705	14,750	21,650	92,105
12	1,620	55,705	15,500	21,650	92,855
13	1,750	55,705	16,500	21,650	93,855
14	1,880	55,705	17,500	21,650	94,855
15	2,000	55,705	18,500	21,650	95,855
16	2,130	55,705	19,700	21,650	97,055
17	2,240	55,705	20,600	21,650	97,955
18	2,370	55,705	21,700	21,650	99,055
19	2,480	55,705	22,600	21,650	99,955
20	2,590	55,705	23,300	21,650	100,655
21	2,700	55,705	24,250	21,650	101,605
22	2,814	55,705	25,500	21,650	102,855
23	2,900	55,705	26,000	21,650	103,355
24	3,010	55,705	26,950	21,650	104,305
25	3,110	55,705	27,750	21,650	105,105
Total	43,804	$1,392,625	$402,995	$541,250	$2,336,870

Cost per Acre Foot - $53.34

APPENDIX C

HELENA VALLEY PROJECT

Cost of 25 Year Supply Over A 25 Year Period
U.S.B.R. Allocated Cost of $477,000 Retired
40 Equal Annual Payments

Year	Acre. Feet	Capital Cost Repayment City	Capital Cost Repayment U.S.B.R.	Power Cost	Depreciation Charge	Total Annual
1	600	$ 41,973	$ 19,002	$ 3,620	$ 16,305	$ 80,900
2	600	41,973	19,002	3,830	16,305	81,110
3	600	41,973	19,002	4,040	16,305	81,320
4	600	41,973	19,002	4,250	16,305	81,530
5	710	41,973	19,002	5,250	16,305	82,530
6	850	41,973	19,002	6,600	16,305	83,880
7	990	41,973	19,002	7,800	16,305	85,080
8	1,120	41,973	19,002	9,200	16,305	86,480
9	1,250	41,973	19,002	9,900	16,305	87,180
10	1,380	41,973	19,002	10,650	16,305	87,930
11	1,510	41,973	19,002	11,500	16,305	88,780
12	1,620	41,973	19,002	12,150	16,305	89,430
13	1,750	41,973	19,002	12,880	16,305	90,160
14	1,880	41,973	19,002	13,750	16,305	91,030
15	2,000	41,973	19,002	14,500	16,305	91,780
16	2,130	41,973	19,002	15,400	16,305	92,680
17	2,240	41,973	19,002	16,100	16,305	93,380
18	2,370	41,973	19,002	16,950	16,305	94,230
19	2,480	41,973	19,002	17,700	16,305	94,980
20	2,590	41,973	19,002	18,300	16,305	95,580
21	2,700	41,973	19,002	19,050	16,305	96,330
22	2,814	41,973	19,002	20,000	16,305	97,280
23	2,900	41,973	19,002	20,375	16,305	97,655
24	3,010	41,973	19,002	21,150	16,305	98,430
25	3,110	41,973	19,002	21,750	16,305	99,030
Total	43,804	$1,049,325	$ 475,050*	$316,695	$407,625	$2,248,695

Cost per Acre Foot During Period - $51.34

* Balance due on Principal - $235,000

APPENDIX D

HELENA VALLEY PROJECT

Cost of 25 Year Supply Over 25 Year Period
U. S. B. R. Allocated Cost of $477,000 Retired in 25 Equal Annual Payments

Year	Acre Feet	Capital Cost Repayment City	Capital Cost Repayment U. S. B. R.	Power Cost	Depreciation Charge	Total Annual
1	600	$ 41,973	$ 25,890	$ 3,620	$ 16,305	$ 87,788
2	600	41,973	25,890	3,830	16,305	87,998
3	600	41,973	25,890	4,040	16,305	88,208
4	600	41,973	25,890	4,250	16,305	88,418
5	710	41,973	25,890	5,250	16,305	89,418
6	850	41,973	25,890	6,600	16,305	90,768
7	990	41,973	25,890	7,800	16,305	91,968
8	1,120	41,973	25,890	9,200	16,305	93,368
9	1,250	41,973	25,890	9,900	16,305	94,068
10	1,380	41,973	25,890	10,650	16,305	94,818
11	1,510	41,973	25,890	11,500	16,305	95,668
12	1,620	41,973	25,890	12,150	16,305	96,318
13	1,750	41,973	25,890	12,880	16,305	97,048
14	1,880	41,973	25,890	13,750	16,305	97,918
15	2,000	41,973	25,890	14,500	16,305	98,668
16	2,130	41,973	25,890	15,400	16,305	99,568
17	2,240	41,973	25,890	16,100	16,305	100,268
18	2,370	41,973	25,890	16,950	16,305	101,118
19	2,480	41,973	25,890	17,700	16,305	101,868
20	2,590	41,973	25,890	18,300	16,305	102,468
21	2,700	41,973	25,890	19,050	16,305	103,218
22	2,814	41,973	25,890	20,000	16,305	104,168
23	2,900	41,973	25,890	20,375	16,305	104,543
24	3,010	41,973	25,890	21,150	16,305	105,318
25	3,110	41,973	25,890	21,750	16,305	105,918
Total	43,804	$1,049,325	$ 647,250	$316,695	$407,625	$2,420,895

Cost per Acre Foot - $55.26

APPENDIX E

HELENA VALLEY PROJECT

Cost of 25 Year Supply Over a 25 Year Period
Repayment of U. S. B. R. Allocated Cost of $477,000
As Proposed By U. S. B. R.

Year	Acre Feet	Capital Cost Repayment City	Capital Cost Repayment U. S. B. R.	Power Cost	Depreciation Charge	Total Annual
1	600	$ 41,973	$ 9,800	$ 3,620	$ 16,305	$ 71,698
2	600	41,973	9,800	3,830	16,305	71,908
3	600	41,973	9,800	4,040	16,305	72,118
4	600	41,973	9,800	4,250	16,305	72,328
5	710	41,973	11,780	5,250	16,305	75,308
6	850	41,973	14,300	6,600	16,305	79,178
7	990	41,973	16,820	7,800	16,305	82,898
8	1,120	41,973	19,160	9,200	16,305	86,638
9	1,250	41,973	21,500	9,900	16,305	89,678
10	1,380	41,973	23,840	10,650	16,305	92,768
11	1,510	41,973	26,180	11,500	16,305	95,958
12	1,620	41,973	28,160	12,150	16,305	98,588
13	1,750	41,973	30,500	12,880	16,305	101,658
14	1,880	41,973	32,840	13,750	16,305	104,868
15	2,000	41,973	35,000	14,500	16,305	107,778
16	2,130	41,973	37,340	15,400	16,305	111,018
17	2,240	41,973	39,320	16,100	16,305	113,698
18	2,370	41,973	41,660	16,950	16,305	116,888
19	2,480	41,973	43,640	17,700	16,305	119,618
20	2,590	41,973	45,620	18,300	16,305	122,198
21	2,700	41,973	47,600	19,050	16,305	124,928
22	2,814	41,973	49,652	20,000	16,305	127,930
23	2,900	41,973	51,200	20,375	16,305	129,853
24	3,010	41,973	53,180	21,150	16,305	132,608
25	3,110	41,973	54,980	21,750	16,305	135,008
Total	43,804	$1,049,325	$763,472	$316,695	$407,625	$2,537,117

Cost per Acre Foot - $57.91

APPENDIX F

HELENA VALLEY PROJECT

Cost of 50 Year Supply Over A 25 Year Period U. S. B. R. Allocated Cost of $728,000 Retired in 25 Equal Annual Payments

Year	Acre Feet	Capital Cost Repayment City	Capital Cost Repayment U. S. B. R.	Power Cost	Depreciation Charge	Total Annual
1	600	$ 41,973	$ 39,512	$ 3,620	$ 16,305	$ 101,410
2	600	41,973	39,512	3,830	16,305	101,620
3	600	41,973	39,512	4,040	16,305	101,830
4	600	41,973	39,512	4,250	16,305	102,040
5	710	41,973	39,512	5,250	16,305	103,040
6	850	41,973	39,512	6,600	16,305	104,390
7	990	41,973	39,512	7,800	16,305	105,590
8	1,120	41,973	39,512	9,200	16,305	106,990
9	1,250	41,973	39,512	9,900	16,305	107,690
10	1,380	41,973	39,512	10,650	16,305	108,440
11	1,510	41,973	39,512	11,500	16,305	109,290
12	1,620	41,973	39,512	12,150	16,305	109,940
13	1,750	41,973	39,512	12,880	16,305	110,670
14	1,880	41,973	39,512	13,750	16,305	111,540
15	2,000	41,973	39,512	14,500	16,305	112,290
16	2,130	41,973	39,512	15,400	16,305	113,190
17	2,240	41,973	39,512	16,100	16,305	113,890
18	2,370	41,973	39,512	16,950	16,305	114,740
19	2,480	41,973	39,512	17,700	16,305	115,490
20	2,590	41,973	39,512	18,300	16,305	116,090
21	2,700	41,973	39,512	19,050	16,305	116,840
22	2,814	41,973	39,512	20,000	16,305	117,790
23	2,900	41,973	39,512	20,375	16,305	118,165
24	3,010	41,973	39,512	21,150	16,305	118,940
25	3,110	41,973	39,512	21,750	16,305	119,540
Total	43,804	$1,049,325	$ 987,800	$316,695	$407,625	$2,761,445

Cost per Acre Foot - $63.05

APPENDIX G

HELENA VALLEY PROJECT

Cost of 50 Year Supply Over a 25 Year Period U. S. B. R. Allocated Cost of $728,000 Retired in 40 Equal Annual Payments

Year	Acre Feet	Capital Cost Repayment City	Capital Cost Repayment U. S. B. R.	Power Cost	Depreciation Charge	Total Annual
1	600	$ 41,973	$ 29,000	$ 3,620	$ 16,305	$ 90,898
2	600	41,973	29,000	3,830	16,305	91,108
3	600	41,973	29,000	4,040	16,305	91,318
4	600	41,973	29,000	4,250	16,305	91,528
5	710	41,973	29,000	5,250	16,305	92,528
6	850	41,973	29,000	6,600	16,305	93,878
7	990	41,973	29,000	7,800	16,305	95,078
8	1,120	41,973	29,000	9,200	16,305	96,478
9	1,250	41,973	29,000	9,900	16,305	97,178
10	1,380	41,973	29,000	10,650	16,305	97,928
11	1,510	41,973	29,000	11,500	16,305	98,778
12	1,620	41,973	29,000	12,150	16,305	99,428
13	1,750	41,973	29,000	12,880	16,305	100,158
14	1,880	41,973	29,000	13,750	16,305	101,028
15	2,000	41,973	29,000	14,500	16,305	101,778
16	2,130	41,973	29,000	15,400	16,305	102,678
17	2,240	41,973	29,000	16,100	16,305	103,378
18	2,370	41,973	29,000	16,950	16,305	104,228
19	2,480	41,973	29,000	17,700	16,305	104,978
20	2,590	41,973	29,000	18,300	16,305	105,578
21	2,700	41,973	29,000	19,050	16,305	106,328
22	2,814	41,973	29,000	20,000	16,305	107,278
23	2,900	41,973	29,000	20,375	16,305	107,653
24	3,010	41,973	29,000	21,150	16,305	108,428
25	3,110	41,973	29,000	21,750	16,305	109,028
Total	43,804	$1,049,325	$725,000 *	$316,695	$407,625	$2,498,645

Cost per Acre Foot During Period - $57.04

* Balance due on principal - $359,000

HELENA VALLEY PROJECT

Cost of 50 Year Supply Over A 25 Year Period
Partial Repayment of U. S. B. R. Allocated Cost of $728,000
as Proposed by U. S. B. R.

Year	Acre Feet	Capital Cost Repayment City	Capital Cost Repayment * U. S. B. R.	Power Cost	Depreciation Charge	Total Annual
1	600	$ 41,973	$ 7,700	$ 3,620	$ 16,305	$ 69,598
2	600	41,973	7,700	3,830	16,305	69,808
3	600	41,973	7,700	4,040	16,305	70,018
4	600	41,973	7,700	4,250	16,305	70,228
5	710	41,973	9,240	5,250	16,305	72,768
6	850	41,973	11,200	6,600	16,305	76,078
7	990	41,973	13,160	7,800	16,305	79,238
8	1,120	41,973	14,980	9,200	16,305	82,458
9	1,250	41,973	16,800	9,900	16,305	84,978
10	1,380	41,973	18,620	10,650	16,305	87,548
11	1,510	41,973	20,440	11,500	16,305	90,218
12	1,620	41,973	21,980	12,150	16,305	92,408
13	1,750	41,973	23,800	12,880	16,305	94,958
14	1,880	41,973	25,620	13,750	16,305	97,648
15	2,000	41,973	27,300	14,500	16,305	100,078
16	2,130	41,973	29,120	15,400	16,305	102,798
17	2,240	41,973	30,660	16,100	16,305	105,038
18	2,370	41,973	32,480	16,950	16,305	107,708
19	2,480	41,973	34,020	17,700	16,305	109,998
20	2,590	41,973	35,560	18,300	16,305	112,138
21	2,700	41,973	37,100	19,050	16,305	114,428
22	2,814	41,973	38,656	20,000	16,305	116,974
23	2,900	41,973	39,900	20,375	16,305	118,553
24	3,010	41,973	41,440	21,150	16,305	120,868
25	3,110	41,973	42,840	21,750	16,305	122,868
Total	43,804	$1,049,325	$595,756 **	$316,695	$407,625	$ 2,369,401

* Exclusive of $2,000.00 O & M Charge

** Balance due on Principal - $577,000

Cost per Acre Foot for Period - $54.10

HELENA VALLEY PROJECT

Cost of Supply Over a 50 Year Period - U. S. B. R. Allocated Cost of $728,000 Retired in 40 Equal Annual Payments. City Cost of Duplication Retired in The Last 25 Years of 50 Year Period

Year	Acre Feet	Capital Cost Repayment City	Capital Cost Repayment U. S. B. R.	Power Cost	Depreciation Charge	Total Annual
26	3,210	$ 41,973	$ 29,000	$ 22,374	$ 29,235	$ 122,582
27	3,310		29,000	23,071		123,279
28	3,400		29,000	23,698		123,906
29	3,500		29,000	24,395		124,603
30	3,600		29,000	25,092		125,300
31	3,700		29,000	25,789		125,997
32	3,800		29,000	26,486		126,694
33	3,900		29,000	27,183		127,391
34	4,000		29,000	27,880		128,088
35	4,100		29,000	28,577		128,785
36	4,200		29,000	29,274		129,482
37	4,300		29,000	29,971		130,179
38	4,400		29,000	30,668		130,876
39	4,500		29,000	31,365		131,573
40	4,600		29,000	32,062		132,270
41	4,700			32,759		103,967
42	4,800			33,456		104,664
43	4,900			34,153		105,361
44	5,000			34,850		106,058
45	5,100			35,547		106,755
46	5,200			36,244		107,452
47	5,300			36,941		108,149
48	5,400			37,638		108,846
49	5,500			38,335		109,543
50	5,600	41,973		39,032	29,235	110,240
		1,049,325	435,000	766,840	730,875	2,982,040
Scheme G		1,049,325	725,000	316,695	407,625	2,498,645
Total		$ 2,098,650	$1,160,000	$1,083,535	$1,138,500	$ 5,480,685

Cost of Supply Over a 50 Year Retirement of
Additional Capital Cost Retired in
25 Equal Annual Payments

Year	Acre Feet	Capital Cost Repayment	Power Cost	Depreciation Charge	Total Annual
26	3,210	$ 55,705	$ 28,569	$ 38,800	$ 123,074
27	3,310		29,459		123,964
28	3,400		30,260		124,765
29	3,500		31,150		125,655
30	3,600		32,040		126,545
31	3,700		32,930		127,435
32	3,800		33,820		128,325
33	3,900		34,710		129,215
34	4,000		35,600		130,105
35	4,100		36,490		130,995
36	4,200		37,380		131,885
37	4,300		38,270		132,775
38	4,400		39,160		133,665
39	4,500		40,050		134,555
40	4,600		40,940		135,445
41	4,700		41,830		136,335
42	4,800		42,720		137,225
43	4,900		43,610		138,115
44	5,000		44,500		139,005
45	5,100		45,390		139,895
46	5,200		46,280		140,785
47	5,300		47,170		141,675
48	5,400		48,060		142,565
49	5,500		48,950		143,455
50	5,600	55,705	49,840	38,800	144,345
		1,392,625	979,178	970,000	3,341,803
Scheme B		1,392,625	402,995	541,250	2,336,870
Total		$ 2,785,250	$1,382,173	$1,511,250	$ 5,678,673

APPENDIX K

U. S. B. R. HELENA VALLEY PROJECT - CITY PARTICIPATION

ALLOCATION OF COSTS FOR 40 YEAR PERIOD

As Proposed By U. S. B. R.

Year	Payment	Payment * Less $2000 O & M	Principal	Interest 2-1/2%	Applied to Principal
			$728,000.00		
1	9,700.00	7,700.00	738,500.00	18,200.00	/ 10,500.00
2	9,700.00	7,700.00	749,262.50	18,462.50	/ 10,762.50
3	9,700.00	7,700.00	760,294.06	18,731.56	/ 11,031.56
4	9,700.00	7,700.00	771,601.41	19,007.35	/ 11,307.35
5	11,240.00	9,240.00	781,651.45	19,290.04	/ 10,050.04
6	13,200.00	11,200.00	789,992.74	19,541.29	/ 8,341.29
7	15,160.00	13,160.00	796,582.56	19,749.82	/ 6,589.82
8	16,980.00	14,980.00	801,517.12	19,914.56	/ 4,934.56
9	18,800.00	16,800.00	804,755.05	20,037.93	/ 3,237.93
10	20,620.00	18,620.00	806,253.93	20,118.88	/ 1,498.88
11	22,440.00	20,440.00	805,970.28	20,156.35	- 283.65
12	23,980.00	21,980.00	804,139.54	20,149.26	- 1,830.74
13	25,800.00	23,800.00	800,443,03	20,103.49	- 3,696.51
14	27,620.00	25,620.00	794,834.11	20,011.08	- 5,608.92
15	29,300.00	27,300.00	787,404.96	19,870.85	- 7,429.15
16	31,120.00	29,120.00	777,970.08	19,685.12	- 9,434.88
17	32,660.00	30,660.00	766,759.33	19,449.25	- 11,210.75
18	34,480.00	32,480.00	753,448.31	19,168.98	- 13,311.02
19	36,020.00	34,020.00	738,264.52	18,836.21	- 15,183.79
20	37,560.00	35,500.00	721,221.13	18,456.61	- 17,043.39
21	39,100.00	37,100.00	702,151.66	18,030.53	- 19,069.47
22	40,696.00	38,636.00	681,069.45	17,553.79	- 21,082.21
23	41,900.00	39,900.00	658,196.19	17,026.74	- 22,873.26
24	43,440.00	41,440.00	633,211.09	16,454.90	- 24,985.10
25	44,840.00	42,840.00	606,201.37	15,830.28	- 27,009.72
26	46,240.00	44,240.00	577,116.40	15,155.03	- 29,084.97
27	47,640.00	45,640.00	545,904.31	14,427.91	- 31,212.09
28	48,900.00	46,900.00	512,651.92	13,647.61	- 33,252.39
29	50,300.00	48,300.00	477,168.22	12,816.30	- 35,483.70
30	51,700.00	49,700.00	439,397.43	11,929.21	- 37,770.79
31	53,100.00	51,100.00	399,282.37	10,984.94	- 40,115.06
32	54,500.00	52,500.00	356,764.43	9,982.06	- 42,517.94
33	55,900.00	53,900.00	311,783.54	8,919.11	- 44,980.89
34	57,300.00	55,300.00	264,278.13	7,794.59	- 47,505.41
35	58,700.00	56,700.00	214,185.08	6,606.95	- 50,093.05
36	60,100.00	58,100.00	161,439.71	5,354.63	- 52,745.37
37	61,360.00	59,360.00	106,115.70	4,035.99	- 55,324.01
38	62,620.00	60,620.00	48,148.59	2,652.89	- 57,967.11
39	64,020.00	62,020.00	- 12,667.70	1,203.71	- 60,816.29
40	65,280.00	63,280.00	- 76,264.39	- 316.69	- 63,596.69

U.S.B.R. HELENA VALLEY PROJECT - CITY PARTICIPATION

ALLOCATION OF PAYOUT OVER 40-YEAR PERIOD

As suggested by Engineers

Year	Base Payment 600 A. F.	Excess At $7/A.F.	Total Annual	Principal	Interest At 2-1/2 %	Applied to Principal
				$728,000.00		
1	$18,200.00	$ --	$18,200.00	728,000.00	$18,200.00	$ --
2		--	18,200.00	728,000.00	18,200.00	--
3		--	18,200.00	728,000.00	18,200.00	--
4		--	18,200.00	728,000.00	18,200.00	--
5		770.00	18,970.00	727,230.00	18,200.00	770.00
6		1,750.00	19,950.00	725,460.75	18,180.75	1,769.25
7		2,730.00	20,930.00	722,667.27	18,136.52	2,793.48
8		3,640.00	21,840.00	718,893.95	18,066.68	3,773.32
9		4,550.00	22,750.00	714,116.30	17,972.35	4,777.65
10		5,460.00	23,660.00	708,309.21	17,852.91	5,807.09
11		6,370.00	24,570.00	701,446.94	17,707.73	6,862.27
12		7,140.00	25,340.00	693,643.11	17,536.17	7,803.83
13		8,050.00	26,250.00	684,734.19	17,341.08	8,908.92
14		8,960.00	27,160.00	674,692.54	17,118.35	10,041.65
15		9,800.00	28,000.00	663,559.85	16,867.31	11,132.69
16		10,710.00	28,910.00	651,238.85	16,589.00	12,321.00
17		11,480.00	29,680.00	637,839.82	16,280.97	13,399.03
18		12,390.00	30,590.00	623,195.82	15,946.00	14,644.00
19		13,160.00	31,360.00	607,415.72	15,579.90	15,780.10
20		13,930.00	32,130.00	590,471.11	15,185.39	16,944.61
21		14,700.00	32,900.00	572,332.89	14,761.78	18,138.22
22		15,498.00	33,698.00	552,943.21	14,308.32	19,389.68
23		16,100.00	34,300.00	532,466.79	13,823.58	20,476.42
24		16,870.00	35,070.00	510,708.46	13,311.67	21,758.33
25		17,570.00	35,770.00	487,706.17	12,767.71	23,002.29
26		18,270.00	36,470.00	463,428.82	12,192.65	24,277.35
27		18,970.00	37,170.00	437,844.54	11,585.72	25,584.28
28		19,600.00	37,800.00	410,990.65	10,946.11	26,853.89
29		20,300.00	38,500.00	382,765.42	10,274.77	28,225.23
30		21,000.00	39,200.00	353,134.56	9,569.14	29,630.86
31		21,700.00	39,900.00	322,062.92	8,828.36	31,071.64
32		22,400.00	40,600.00	289,514.49	8,051.57	32,548.43
33		23,100.00	41,300.00	255,452.35	7,237.86	34,062.14
34		23,800.00	42,000.00	219,838.66	6,386.31	35,613.69
35		24,500.00	42,700.00	182,634.63	5,495.97	37,204.03
36		25,200.00	43,400.00	143,800.50	4,565.87	38,834.13
37		25,830.00	44,030.00	103,365.51	3,595.01	40,434.99
38		26,460.00	44,660.00	61,289.65	2,584.14	42,075.86
39		27,160.00	45,360.00	17,461.89	1,532.24	43,827.76
40	18,200.00	27,790.00	45,990.00	-28,091.56	436.55	45,553.45

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